

The Korean Intellectual Property Office (KR) Registered Patent (B1)

(51) Int.Cl.

H04N 5/225

(11) Registration No 10-0220849

(24) Registration Date 1999-06-23

(45) Published Date 1999-09-15

(21) Application No 10-1996-0072736

(65) Unexamined Publication 10-1998-0053617
No

(22) Application Date 1996-12-27

(43) Unexamined Publication 1998-03-25
Date

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(54) AUDIO DESHUFFLING APPARATUS FOR DIGITAL VIDEO CAMERA

 Abstract

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The present invention relates to the audio deshuffling apparatus for dishuffling and being restored audio data which are shuffled in order to disperse the burst error of the record reproduction system of the digital audio signal as to the digital video camera (DVC : Digital Video Camera) into the original sample number, and as long as it is shuffled, the word number, the sync number, and the track number and byte weight are successively saved from audio data of frame and the deshuffling operation is performed.

Therefore, since configuration becomes streamlined and the present invention has the fast working speed to that, the real time processing is facilitated.

PURPOSE: A deshuffling device for audio of a DVC(digital video camera) is provided to simplify a circuit and to improve process speed through successively obtaining word, synchronization, and track numbers and byte weight from audio data of shuffled frame.

CONSTITUTION: A word number sample unit(100) samples word numbers by counting shuffled audio sample data by word unit. A first counter(110) outputs synchronized block numbers by counting the word numbers by nine. A second counter(120) outputs a tracking number by counting the synchronized block numbers by ten. A multiplier(130) outputs byte location number by multiplying four to the word number. A synchronization decoder(140) samples synchronize weight by receiving byte location number and synchronized block numbers. A track and synchronization number decoder outputs deshuffled audio sample data by decoding the synchronized block number, the track number, and the synchronization weight. Thus, structure is simplified while improving operation speed.

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Fig. 2

Description

Brief explanation of the drawing

- 2 Fig. 1 is a shuffling pattern drawing being general
- 3 Fig. 2 is a configuration diagram of the audio deshuffling apparatus
- 4 Fig. 3 is a drawing illustrating the operation of the motive decoder of Fig. 2
- 5 Fig. 4 is a decoding operational flow chart of the sync number decoder and magnetic track of Fig. 2
- 6 * The description of reference numerals of the main elements in drawings.
- 7 100: word number extracting unit 101,102,110,120: counter.

- 8 130: multiplier 140: motive decoder.
- 9 150: the magnetic track and sync number decoder.

► Details of the Invention

► Purpose of the Invention

The Technical Field to which the Invention Belongs and the Prior Art in that Field

- 10 The present invention relates to the audio deshuffling apparatus for dishuffling and being restored audio data which are shuffled in order to disperse the burst error of the record reproduction system of the digital audio signal as to the digital video camera (DVC : Digital Video Camera) into the original sample number.
- 11 Generally, in the digital video for camera audio processor, the audio encoding mode is supported as 48KHz of two-channel, 4 tree of 32KHz mode of 44.1KHz and 32KHz mode and 4 channel according to product.
- 12 In this way, it was stored as the rammer frame unit and it converts into encoded two-channel or 4 channel digital audio data so that the burst error randomize this in the audio data track in generation.
- 13 That is, in order to be included in the segment in which the block of inputted digital audio data is identical order is rearranged and superior audio data is recorded in the magnetic recording tape. It says to be this the shuffling loe.
- 14 While the audio sample and dummy data shuffle in one frame but the location is determined as the track number (Track Number : TN), the sync block number (Sync Block Number : SBN), and the byte location number (Byte Position Number : BPN), in order to prevent the burst error the track number , and the sync number and byte location number are determined by the fixed spec.
- 15 For example, the track number , and the sync block number and byte locaion number are determined by the spec of 48KHz 525/60 system 2 channel mode according to the regulation like showing for the lower part type.
- 16 [Equation 1]
- 17 The $TN = (\text{int}(Dn/3) + 2 \times (Dn \text{ MOD } 3)) \text{ MOD } 5$ ---- primary channel.
- 18 The $TN = (\text{int}(Dn/3) + 2 \times (Dn \text{ MOD } 3)) \text{ MOD } 5 + 5$ ---- second channel.
- 19 [Equation 2]
- 20 $SBN = 3 \times (Dn \text{ MOD } 3) + \text{int}(Dn \text{ MOD } 45) / 15)$

after the process of the production time deshuffling to the original sample number.

Technical challenges of the invention

- 32 Therefore, an object of the present invention are to provide the audio deshuffling apparatus which successively saves the word number, the sync number, and the track number and byte weight from audio data of frame as long as it is shuffled as to the digital video camera and streamlines circuit and has the fast processing speed to that.
- Structure & Operation of the Invention
- 33 To accomplish the above objects, it has the audio deshuffling apparatus of the digital video camera as feature to count shuffled audio sample data in the special word unit according to the channel mode and be comprised of the word number extracting unit extracting the word number, the first counter counting the word number outputted from the word number extracting unit in 9 unit and outputs the sync block number, the second counter counting the sync block number outputted from the first counter in 10 unit and outputs the track number, the multiplier multiplying the word number outputted from the word number extracting unit by 4 and outputs the byte location number, the motive decoder decoding the sync block number outputted from the first counter and the byte location number outputted from multiplier to input and extracts the motive weighted value (Sync Weight), and the magnetic track and the sync number decoder outputting audio sample data decoding the sync block number, outputted from the first counter the track number outputted from the second counter and the motive weighted value outputted from the motive decoder to input and is dishuffled.
- 34 Hereinafter, the embodiment of the present invention attached is circumstantially illustrated.
- 35 As shown in Fig. 2, it is comprised of the audio deshuffling apparatus of the digital video camera of the word number extracting unit (100), counters (110, 120), multiplier (130), motive decoder (140), the magnetic track and sync number decoder (150).
- 36 It counts the shuffled audio sample data (sDn) in the special word unit according to the channel mode and the word number extracting unit (100) extracts the word number (WN). It is comprised of the counter (102) counting the shuffled audio sample data (sDn) as described above in 24 word unit and outputs the word number (WN) in case of 2 channel mode in case of the counter (101) and 4 channel mode counting the shuffled audio sample data (sDn) as described above in 35 word unit and outputs the word number (WN).
- 37 It counts the word number (WN) outputted from the word number extracting unit (100) in 9 unit and the counter (110) outputs the sync block number (SBN).
- 38 It counts the sync block number (SBN) outputted from the counter (110) in 10 unit and the counter (120) outputs the track number (TN).

- 39 # multiplies the word number (WN) outputted from the word number extracting unit (100) by 4 and the multiplier (130) outputs the byte location number (BPN). 2 bit shift right is the word number (WN) outputted from the word number extracting unit (100) comprised of shifter.
- 40 The sync block number (SBN) outputted from the counter (110) and the byte location number (BPN) outputted from the multiplier (130) are decoded from the motive decoder (140) to input and the motive weighted value (Sync Weight : SW) is extracted. In case the sync block number (SBN) outputted from the counter (110) is 0, the byte location number (BPN) outputted from the multiplier (130) is outputted to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 1, 15 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 2, 30 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 3, 10 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 4, 25 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 5, 40 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 6, 5 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 7, 20 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In order to case the sync block number (SBN) outputted from the counter (110) is 8, 35 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW) it decodes.
- 41 The magnetic track and sync number decoder (150) output the audio sample data (dDn) decoding the sync block number (SBN) outputted from the counter (110) the track number (TN) outputted from the counter (120) and the motive weighted value (SW) outputted from the motive decoder (140) to input and is dishuffled. It outputs to the audio sample data (dDn) which adds -9 to the motive weighted value (SW) outputted from the motive decoder (140) in case the sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 2 or 7 and which is outputted from the counter (110) is 3 or 4 and is dishuffled. It outputs to the audio sample data (dDn) which adds 6 to the motive weighted value (SW) outputted from the motive decoder (140) in case it is not sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 2 or 7 and which is outputted from the counter (110) 3 or 4 and is dishuffled. It outputs to the audio sample data (dDn) which adds -6 to the motive weighted value (SW) outputted from the motive decoder (140) in case the sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 3 or 8 and which is outputted from the counter (110) is 3 or 5 and is dishuffled. It outputs to the audio sample data (dDn) in which the sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 3 or 8 and which is outputted from the counter

(110) adds 9 to the motive weighted value (SW) in which 3 or 5 is outputted from *** case motive decoder (140) and which is dishuffled. It outputs to the audio sample data (dDn) which adds -3 to the motive weighted value (SW) outputted from the motive decoder (140) in case the sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 4 or 9 and which is outputted from the counter (110) is one among 3, 4, 5, 6, 7 and 8 and is dishuffled. It outputs to the audio sample data (dDn) which the sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 4 or 9 and which is outputted from the counter (110) adds 12 to the motive weighted value (SW) outputted from the motive decoder (140) among 3, 4, 5, 6, 7 and 8 in case of being not one and is dishuffled. In case the track number (TN) outputted from the counter (120) is 0 or 5, it outputs to the audio sample data (dDn) which is the motive weighted value (SW) outputted from the motive decoder (140) dishuffled. In order to output to the audio sample data (dDn) which adds 3 to the motive weighted value (SW) outputted from the motive decoder (140) in case the track number (TN) outputted from the counter (120) is 1 or 6 and is dishuffled it decodes.

- 42 In this way, the operation of the audio deshuffling apparatus of the comprised digital video camera is illustrated.
- 43 Firstly, the word number (WN) the shuffled audio sample data (sDn) is counted in the special word unit according to the channel mode is extracted from the word number extracting unit (100).
- 44 That is, according to the channel mode signal, counters (101, 102) of the word number extracting unit (100) perform the counting operation. The counter (101) operates in case of 2 channel mode and the shuffled audio sample data (sDn) as described above is counted in 35 word unit and the word number (WN) is outputted. The counter (102) operates in case of 4 channel mode and the shuffled audio sample data (sDn) as described above is counted in 24 word unit and the word number (WN) is outputted.
- 45 In the word number (WN) outputted from the word number extracting unit (100) is the counter (110), it is counted to 9 unit and it is outputted to the sync block number (SBN) and it is outputted to the motive decoder (140), and the counter (120), the magnetic track and sync number decoder (150).
- 46 In the counter (120), the sync block number (SBN) outputted from the counter (110) is counted in 10 unit and the track number (TN) is outputted. The word number (WN) outputted from the word number extracting unit (100) 2 bit shift is written and the byte location number (BPN) is outputted in the multiplier (130).
- 47 It is decoded in the motive decoder (140) into the sync block number (SBN) and the byte location number (BPN) outputted from the multiplier (130) and outputted from the counter (110) the motive weighted value (Sync Weight : SW) is extracted.
- 48 That is, in the motive decoder (140), if this is illustrated according to the sync block number (SBN) outputted from the counter (110) to add the respective other value to the byte location number (BPN) and output in the motive decoder (140) to the motive weighted value

(SW), as shown in

Fig. 3, it is the same as that of the next time.

- 49 In case the sync block number (SBN) outputted from the counter (110) is 0, the byte location number (BPN) outputted from the multiplier (130) is outputted to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 1, 15 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 2, 30 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW).
- 50 Moreover, in case the sync block number (SBN) outputted from the counter (110) is 3, 10 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 4, 25 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 5, 40 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW).
- 51 Moreover, in case the sync block number (SBN) outputted from the counter (110) is 6, 5 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 7, 20 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW). In case the sync block number (SBN) outputted from the counter (110) is 8, 35 is added to the byte location number (BPN) outputted from the multiplier (130) and it outputs to the motive weighted value (Sync Weight : SW).
- 52 In this way, it is inputted to the magnetic track and sync number decoder (150) with the track number (TN) and sync block number (SBN) and the motive weighted value (SW) which is decoded in the motive decoder (140) and is outputted is outputted to the audio sample data (dDn) dishuffled as ***.
- 53 That is, in the magnetic track and sync number decoder (150), the audio sample data (dDn) decoding the sync block number (SBN), outputted from the counter (110) the track number (TN) outputted from the counter (120) and the motive weighted value (SW) outputted from the motive decoder (140) from as shown in Fig. 4 to input and is dishuffled is outputted. This is illustrated.
- 54 Firstly, the deshuffling audio sample data (dDn) which searches the sync block number (SBN) after searching the track number (TN) outputted from the counter (120) and comes is outputted.

- 55 That is, it searches whether the track number (TN) is 2 or 7 and or not if it is 2 or 7, it search (200)s whether the sync block number (SBN) outputted from the counter (110) is 3 or 4 or not (201). At this time, it outputs to the audio sample data (dDn) which adds -9 to the motive weighted value (SW) outputted from the motive decoder (140) if the sync block number (SBN) is 3 or 4 and is dishuffled (202). Moreover, it outputs to the audio sample data (dDn) which adds -9 to the motive weighted value (SW) outputted from the motive decoder (140) in case it is not sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 2 or 7 and which is outputted from the counter (110) 3 or 4 and is dishuffled (203).
- 56 Moreover, in case it is not search result (200) track number (TN) 2 or 7, it searches whether the track number (TN) is 3 or 8 and or not if it is 3 or 8, it search (204)s whether the sync block number (SBN) outputted from the counter (110) is 3 or 5 or not (205). At this time, it outputs to the audio sample data (dDn) which adds -6 to the motive weighted value (SW) outputted from the motive decoder (140) if the sync block number (SBN) is 3 or 5 and is dishuffled (206). Moreover, it outputs to the audio sample data (dDn) which adds 9 to the motive weighted value (SW) outputted from the motive decoder (140) in case it is not sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 3 or 8 and which is outputted from the counter (110) 3 or 5 and is dishuffled (207).
- 57 Moreover, in case it is not search result (204) track number (TN) 3 or 8, it searches whether the track number (TN) is 4 or 9 and or not if it is 4 or 9, it search (208)s whether the sync block number (SBN) outputted from the counter (110) is one among 3, 4, 5, 6, 7 and 8 or not (209). At this time, it outputs to the audio sample data (dDn) which adds -3 to the motive weighted value (SW) outputted from the motive decoder (140) if the sync block number (SBN) is one among 3, 4, 5, 6, 7 and 8 and is dishuffled (210). Moreover, it outputs to the audio sample data (dDn) which the sync block number (SBN) in which the track number (TN) outputted from the counter (120) is 4 or 9 and which is outputted from the counter (110) adds 12 to the motive weighted value (SW) outputted from the motive decoder (140) among 3, 4, 5, 6, 7 and 8 in case of being not one and is dishuffled (211).
- 58 Moreover, it outputs to the audio sample data (dDn) which search (212)s in case it is not search result (208) track number (TN) 4 or 9 whether the track number (TN) is 0 or 5 and or not is the motive weighted value (SW) outputted from the motive decoder (140) dishuffled if it is 0 or 5 (213).
- 59 Moreover, 1 or 6 becomes the track number (TN) in case it is not search result (212) track number (TN) 0 or 5. Therefore, it outputs to the audio sample data (dDn) which adds 3 to the motive weighted value (SW) outputted from the motive decoder (140) if the track number (TN) is 1 or 6 and is dishuffled (214).
- 60 in this way, as long as is shuffled with the extracted track number (TN), the motive weighted value (SW) and sync block number (SBN), it is dishuffled in the audio sample data (sDn) of frame and as long as it is dishuffled, it is outputted to the audio sample data (dDn) of frame.

- 61 As illustrated in the above, since configuration becomes streamlined and the audio deshuffling apparatus of the digital video camera has the fast working speed, the real time processing is facilitated.

Scope of Claims

Claim[1]:

- 62 The audio deshuffling apparatus of the digital video camera, wherein the shuffled audio sample data (sDn) is counted in the special word unit according to the channel mode and it is comprised of the word number extracting unit (100) extracting the word number (WN), the first counter (110) counting the word number (WN) outputted from the word number extracting unit (100) in 9 unit and outputs the sync block number (SBN), the second counter (120) counting the sync block number (SBN) outputted from the first counter (110) in 10 unit and outputs the track number (TN), the multiplier (130) multiplying the word number (WN) outputted from the word number extracting unit (100) by 4 and outputs the byte location number (BPN), the motive decoder (140) decoding the sync block number (SBN) outputted from the first counter (110) and the byte location number (BPN) outputted from the multiplier (130) to input and extracts the motive weighted value (Sync Weight : SW), and the magnetic track and the sync number decoder (150) outputting the audio sample data (dDn) decoding the sync block number (SBN), outputted from the first counter (110) the track number (TN) outputted from the second counter (120) and the motive weighted value (SW) outputted from the motive decoder (140) to input and is dishuffled.

Claim[2]:

- 68 The audio deshuffling apparatus of the digital video camera of claim 1, wherein the word number extracting unit (100) counts the shuffled audio sample data (sDn) as described above in 35 word unit and it is comprised of the third counter (101) outputting the word number (WN), and the fourth counter (102) counting the shuffled audio sample data (sDn) as described above in 24 word unit and outputs the word number (WN) in case of 4 channel mode in case of 2 channel mode.

Claim[3]:

- 69 The audio deshuffling apparatus of the digital video camera of claim 1, wherein in the multiplier (130), 2 bit shift right is the word number (WN) outputted from the word number extracting unit (100) comprised of shifter.

Claim[4]:

- 70 The audio deshuffling apparatus of the digital video camera of claim 1, wherein in the motive decoder (140), it outputs the byte location number (BPN) outputted from the multiplier (130) to the motive weighted value (Sync Weight : SW) in case the sync block number (SBN) outputted from the first counter (110) is 0; it adds 15 to the byte location number (BPN) outputted from the multiplier (130) in case the sync block number (SBN) outputted from the first counter (110) is 1 and it outputs to the motive weighted value (Sync Weight : SW); it adds 30 to the byte location number (BPN) outputted from the multiplier (130) in case the sync block number (SBN) outputted from

the first counter (110) is 2 and it outputs to the motive weighted value (Sync Weight : SW); it adds 10 to the byte location number (BPN) outputted from the multiplier (130) in case the sync block number (SBN) outputted from the first counter (110) is 3 and it outputs to the motive weighted value (Sync Weight : SW); it adds 25 to the byte location number (BPN) outputted from the multiplier (130) in case the sync block number (SBN) outputted from the first counter (110) is 4 and it outputs to the motive weighted value (Sync Weight : SW); it adds 40 to the byte location number (BPN) outputted from the multiplier (130) in case the sync block number (SBN) outputted from the first counter (110) is 5 and it outputs to the motive weighted value (Sync Weight : SW); it adds 5 to the byte location number (BPN) outputted from the multiplier (130) in case the sync block number (SBN) outputted from the first counter (110) is 6 and it outputs to the motive weighted value (Sync Weight : SW); it adds 20 to the byte location number (BPN) outputted from the multiplier (130) in case the sync block number (SBN) outputted from the first counter (110) is 7 and it outputs to the motive weighted value (Sync Weight : SW); and it adds 35 to the byte location number (BPN) outputted from the multiplier (130) in case the sync block number (SBN) outputted from the first counter (110) is 8 and it outputs to the motive weighted value (Sync Weight : SW).

Claim(5) :

- 71 As to claim 1, the magnetic track and sync number decoder (150) output to the audio sample data (dDn) which adds -9 to the motive weighted value (SW) outputted from the motive decoder (140) in case the sync block number (SBN) in which the track number (TN) outputted from the second counter (120) is 2 or 7 and which is outputted from the first counter (110) is 3 or 4 and is dishuffled; it outputs to the audio sample data (dDn) which adds 6 to the motive weighted value (SW) outputted from the motive decoder (140) in case it is not sync block number (SBN) in which the track number (TN) outputted from the second counter (120) is 2 or 7 and which is outputted from the first counter (110) 3 or 4 and is dishuffled; it outputs to the audio sample data (dDn) which adds -6 to the motive weighted value (SW) outputted from the motive decoder (140) in case the sync block number (SBN) in which the track number (TN) outputted from the second counter (120) is 3 or 8 and which is outputted from the first counter (110) is 3 or 5 and is dishuffled; it outputs to the audio sample data (dDn) in which the sync block number (SBN) in which the track number (TN) outputted from the second counter (120) is 3 or 8 and which is outputted from the first counter (110) adds 9 to the motive weighted value (SW) in which 3 or 5 is outputted from *** case motive decoder (140) and which is dishuffled; it outputs to the audio sample data (dDn) which adds -3 to the motive weighted value (SW) outputted from the motive decoder (140) in case the sync block number (SBN) in which the track number (TN) outputted from the second counter (120) is 4 or 9 and which is outputted from the first counter (110) is one among 3, 4, 5, 6, 7 and 8 and is dishuffled; it outputs to the audio sample data (dDn) which the sync block number (SBN) in which the track number (TN) outputted from the second counter (120) is 4 or 9 and which is outputted from the first counter (110) adds 12 to the motive weighted value (SW) outputted from the motive decoder (140) among 3, 4, 5, 6, 7 and 8 in case of being not one and is dishuffled; and in case the track number (TN) outputted from the second counter (120) is 0 or 5, it outputs to the audio sample data (dDn) which is the motive weighted value (SW) outputted from the motive decoder (140) dishuffled. The audio deshuffling apparatus of the digital video camera wherein it outputs to the audio sample data (dDn) which adds 3 to the motive weighted value (SW) outputted from the motive decoder (140) in

case the track number (TN) outputted from the second counter (120) is 1 or 6 and is disshuffled.